

# **IDAHO DEPARTMENT OF FISH AND GAME**

## **FEDERAL AID IN FISH RESTORATION 2000 JOB PERFORMANCE REPORT PROGRAM F-73-R-22**

**ROD SANDO, DIRECTOR**



## **REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS NORTH FORK CLEARWATER RIVER BULL TROUT**

**PROJECT: 9**

**By**

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## JOB PERFORMANCE REPORT

State of: Idaho

Name: Regional Fisheries Management  
Investigations F-73-R-22

Project: 9

Title: North Fork Clearwater River Bull Trout  
Investigations

Period Covered: July 1, 1999—June 30, 2000

### ABSTRACT

In 2000, bull trout *Salvelinus confluentus* life history investigations were conducted in the North Fork Clearwater River drainage. Fifty-nine bull trout were captured by hook-and-line in Dworshak Reservoir from April to May. Radio transmitters were surgically implanted into 21 of these fish. Their migration was followed throughout the year to document timing of migration, distribution within the drainage, and spawning locations. Sixteen bull trout migrated out of the reservoir by July 2 and reached their farthest upstream location no later than August 8. The bull trout were delineated into five subgroups based on distribution within the drainage: Black Canyon, Kelly Creek, Weitas Creek, lower North Fork, and Dworshak Reservoir. Seven bull trout migrated into the Black Canyon reach, or 44% of the total upstream radio-tagged migrants. Four (25%) migrated into the Kelly Creek drainage, one (6%) into Weitas Creek, and four (25%) remained in the North Fork Clearwater River downstream of Skull Creek. Redd surveys within six drainages identified 30 redds, with the highest concentration located in Lake Creek.

Forty-six bull trout were captured by gill net or hook-and-line sampling in Fish Lake from June to July 2000. No bull trout were radio-tagged at Fish Lake because they weighed less than 400 g. Angler creel surveys conducted on the lake in August estimated 425 hrs (+/- 192 hrs) of angling pressure. Cutthroat trout *Oncorhynchus clarki* harvest was estimated at 716 (+/-630 95% CI). An estimated 151 (+/- 81 95% CI) cutthroat trout and 227 (+/- 140 95% CI) bull trout were caught and released. Bull trout hooking mortality was estimated to range from a high of 132 (+/- 81 95% CI) and a low of 11 (+/- 7 95% CI). Additional information regarding population size and structure is required to determine the impacts that hooking mortality is having on this bull trout population.

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## INTRODUCTION

In 1971 the construction of Dworshak Dam was completed near the mouth of the North Fork Clearwater River. The 218 m high dam inundated more than 100 km of riverine habitat on the mainstem of the North Fork Clearwater River (NFCR) and its tributaries. With no passage for fish migration, anadromous fish runs have been eliminated within this drainage and impacts on resident species in the basin are not as clear.

Presumably, the construction of Dworshak Dam has significantly reduced the distribution, abundance, and population viability of native resident fish populations in Dworshak Reservoir and its upstream tributaries (Columbia River Basin Fish and Wildlife Authority. 1997). However, the information needed to support this assumption does not exist.

Historical observations document bull trout *S. confluentus* throughout the NFCR basin. Bull trout were found in the basin prior to construction of Dworshak Dam (Cannon 1970). Bull trout are still found in the NFCR, many of its tributaries, and Dworshak Reservoir as documented in earlier studies (Lindland 1987, Statler 1989), (Schriever and Cochnauer 1996), (Weigel and Cross 1997), (Weigel and Zakrajsek 1998). Predicting changes in bull trout population abundance and distribution in the basin is difficult because of the lack of pre- and post-dam data. There is also a lack of information on bull trout populations in basins without dam and reservoir influences to use as comparable controls. As a result of impoundment by Dworshak Dam, we believe direct assessment of the change in bull trout population dynamics is not feasible. However, assessment of the viability of the current bull trout population remaining in the NFCR basin is possible. Determining whether their viability and movements are affected by present operations of Dworshak Dam and its physical attributes could also be determined. Investigation of these issues will help provide the information necessary to assess the need for and determination of strategies to protect and perpetuate a viable population of bull trout in the NFCR basin.

Although bull trout have been observed and collected throughout the basin, little quantitative information is available on their life history, distribution, and abundance. More importantly, other than documentation of presence or absence, no information is available regarding the role of Dworshak Reservoir in the life history and distribution of bull trout in the drainage.

Bull trout populations are prone to habitat disruption and fragmentation (Rieman and McIntyre 1993). Dworshak Dam has possibly isolated and fragmented the Clearwater River bull trout population(s). The impact(s) of severing the migratory corridor between the NFCR and mainstem Clearwater River could be crucial in sustaining a viable bull trout population upstream of Dworshak Dam. Without more information, the disruption of this migratory corridor can only be viewed as a threat to the existence of the NFCR bull trout population.

One segment of this study is to document and assess bull trout populations in NFCR drainage. The second segment is to assess the bull trout population in Fish Lake. Fish Lake is the only high elevation lake in the drainage that supports a significant bull trout population. Little information is available on the basic life history of this lentic population. Also, the role Fish Lake and its bull trout population plays in the dynamics within the NFCR drainage is unknown.

## NORTH FORK CLEARWATER RIVER AND DWORSHAK RESERVOIR

### Objectives

1. Determine migration patterns of bull trout within the North Fork Clearwater River.
2. Determine spatial and temporal distribution of bull trout within Dworshak Reservoir and the North Fork Clearwater River drainage.
3. Identify bull trout spawning sites within the North Fork Clearwater River.
4. Obtain basic life history information on bull trout within Dworshak Reservoir and the North Fork Clearwater River drainage.

### Study Area

The NFCR is a fourth-order stream located in north central Idaho (Figure 1). It has a total drainage area of 2,080 ha with the headwaters extending into the Bitterroot Mountains and forming the western border of Montana. The majority of the drainage is under public ownership by the US Forest Service (USFS) Clearwater National Forest. The major tributaries of the NFCR are Kelly, Cayuse, Skull, Quartz, Orogrande, and Weitas creeks (Figure 1).

Dworshak Dam was constructed in 1971 on the NFCR, 3.2 km upstream from its mouth. The dam is the tallest straight axis concrete dam in the United States at 219 m and is not equipped with fish passage facilities.

Dworshak Reservoir is 86.2 km long and has 295 km of steep shoreline at full pool. It has a total volume of  $4.28 \times 10^9 \text{ m}^3$  that corresponds to a maximum depth of 194 m, mean depth of 56 m, and a surface area of 6,644 ha (Maiolie et al. 1994). The main arms of the reservoir are Elk Creek, the Little North Fork Clearwater River, and the NFCR.

Native resident salmonids found within the drainage include bull trout, westslope cutthroat trout *Oncorhynchus clarki lewisi*, rainbow trout *O. mykiss*, and mountain whitefish *Prosopium williamsoni*. Anadromous fish have been effectively eliminated from the system since the construction of Dworshak Dam blocked return spawning migrations. Prior to that time, chinook salmon *O. tshawytscha* and steelhead trout *O. mykiss* were found throughout the drainage. The system has been stocked with kokanee *O. nerka*, rainbow trout, cutthroat trout, bull trout, smallmouth bass *Micropterus dolomieu*, and largemouth bass *M. salmoides*.

### Methods

From April 17 to May 26, 2000, bull trout were captured by hook-and-line sampling in the upper NFCR arm of Dworshak Reservoir near the slack and flowing water interface. These individuals were believed to be staging for their spawning migration into NFCR. All bull trout were anesthetized in a 60-80 mg/l solution of MS222. Fish were weighed and fork and total lengths were measured. Genetic and scale samples were taken and a Passive Integrated Transponder (PIT) tag inserted into the dorsal sinus or

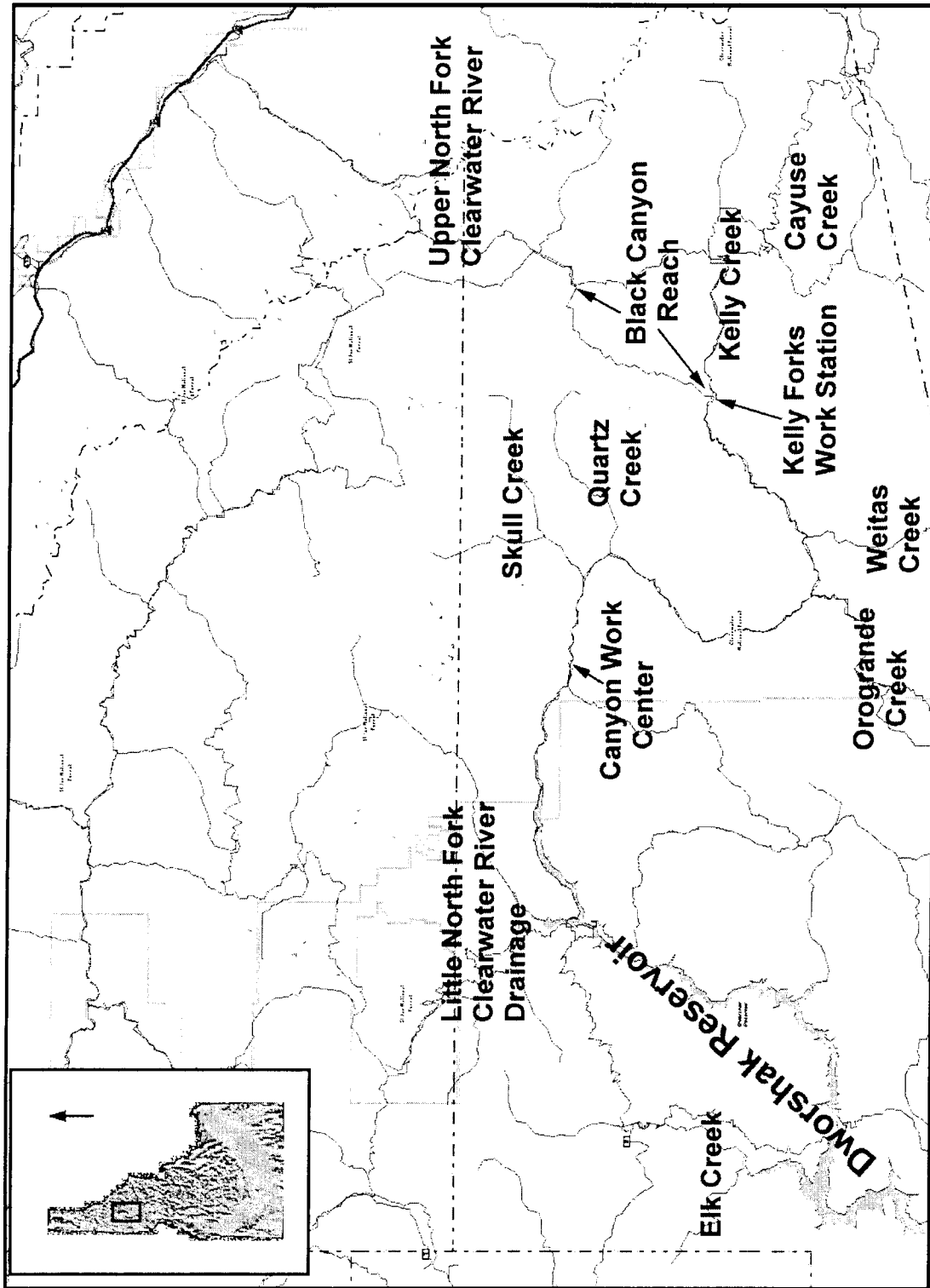


Figure 1. North Fork Clearwater River drainage.

opercular muscle. Bull trout weighing greater than 400 g were candidates for surgical radio transmitter implantation. The surgical procedure is described in Schill et al. (1994). All individuals were allowed to recover in fresh water for approximately 15 minutes and then released at the location of capture.

Radio tracking was accomplished through the use of boat, vehicle, and fixed-wing aircraft throughout the study area. Stationary radio-receiving sites were established at the USFS Canyon Work Center (CWC) (rkm 96.6) and at Kelly Fork Ranger Station (KFR) (rkm 166.5). An individual bull trout was determined to leave or enter the reservoir when it was first recorded on the CWC receiver on its upstream or downstream migration even though there is 4.8 km of free-flowing river between this site and the reservoir. All bull trout will be identified by the frequency of the tag (148.930 (930) and 148.910 (910)) and its code (e.g., 930 - 29).

## **Results**

### **Tagging**

From April 17 to May 26, fifty-nine bull trout were captured using hook-and-line sampling within Dworshak Reservoir (Appendix A). Sampling was conducted 11-19.5 km above the mouth of the Little North Fork Clearwater River within the NFCR arm. The fork length of these individuals was distributed from 190 to 510 mm (Figure 2) and the weight distribution was 110 to 1220 g (Figure 3). Radio transmitters were implanted in 21 individuals, which were greater than 400 g.

### **Migration**

Bull trout migration from the reservoir began on May 22 when the first individual was recorded on the CWC receiver (Table 1). The last individual to leave the reservoir moved to the CWC site on July 2. All bull trout that moved above CWC were tracked throughout the summer, reaching their maximum upstream location for summer residence or spawning no later than August 8 (Table 1). They remained at these areas through the summer until the first week of September, when the first bull trout was documented moving downstream. The first individual that migrated downstream past the CWC receiver was on September 5. Three bull trout were still located in the NFCR on February 7, 2001, distributed between Washington Creek and CWC.

Five tagged individuals were not recorded on the CWC receiver at any time from May to October. It is assumed that these bull trout did not enter the NFCR. It is hypothesized that they either: a) they went below the detectable depth (approximately 10 m) in Dworshak Reservoir seeking thermal refuge from warm summer surface temperatures; b) were lost due to mortality; or c) ascended a tributary that we did not monitor over the summer. These bull trout are individually discussed below.

### **Distribution**

Based on the migration patterns of the 21 radio-tagged bull trout (Appendix B), five subgroup locations were designated within the drainage. These subgroups were Black Canyon, Kelly Creek, Weitas Creek, lower NFCR, and Dworshak (Table 1).

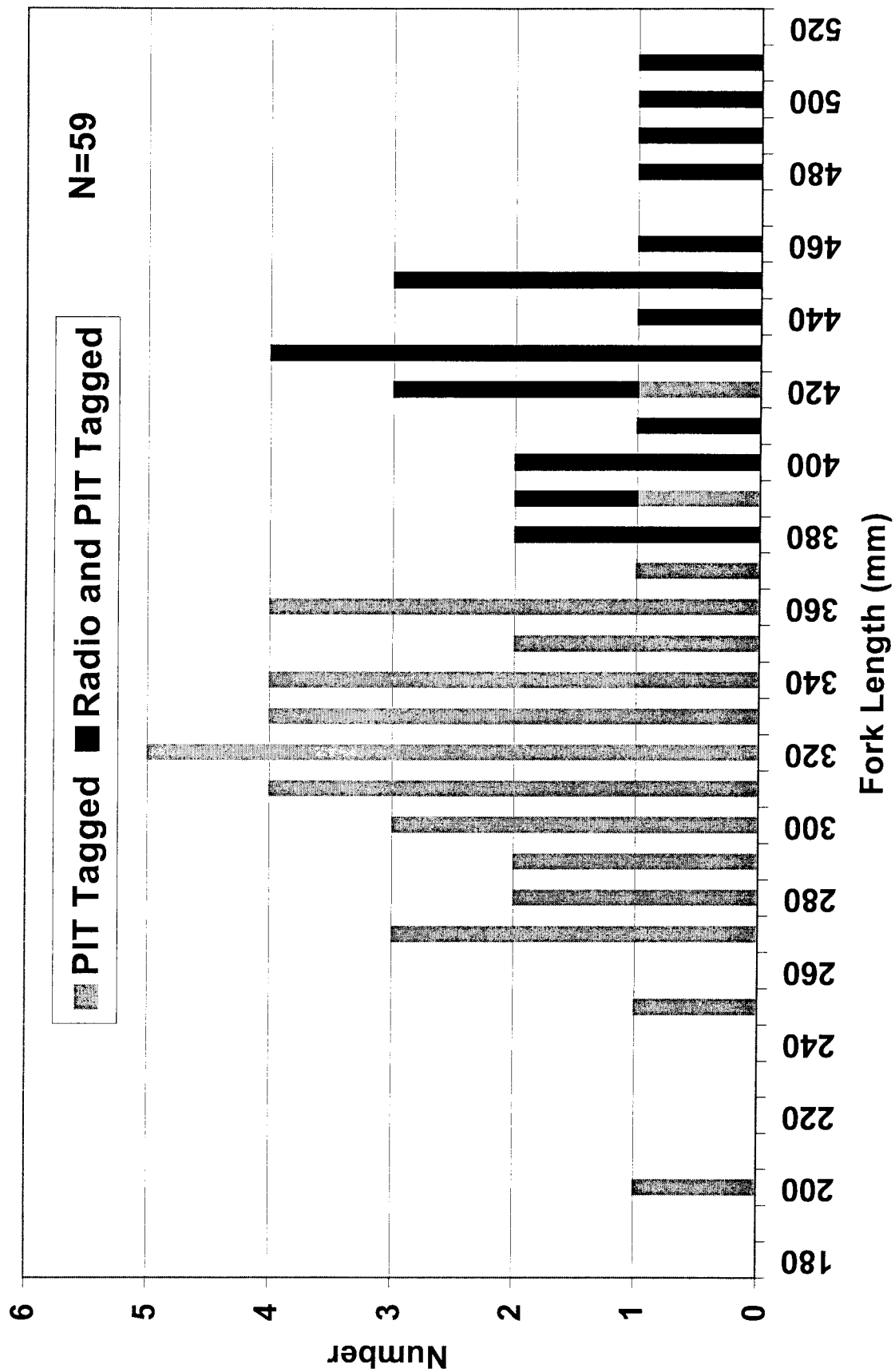


Figure 2. Fork length distribution of bull trout captured by hook-and-line sampling in Dworshak Reservoir, April-May 2000.

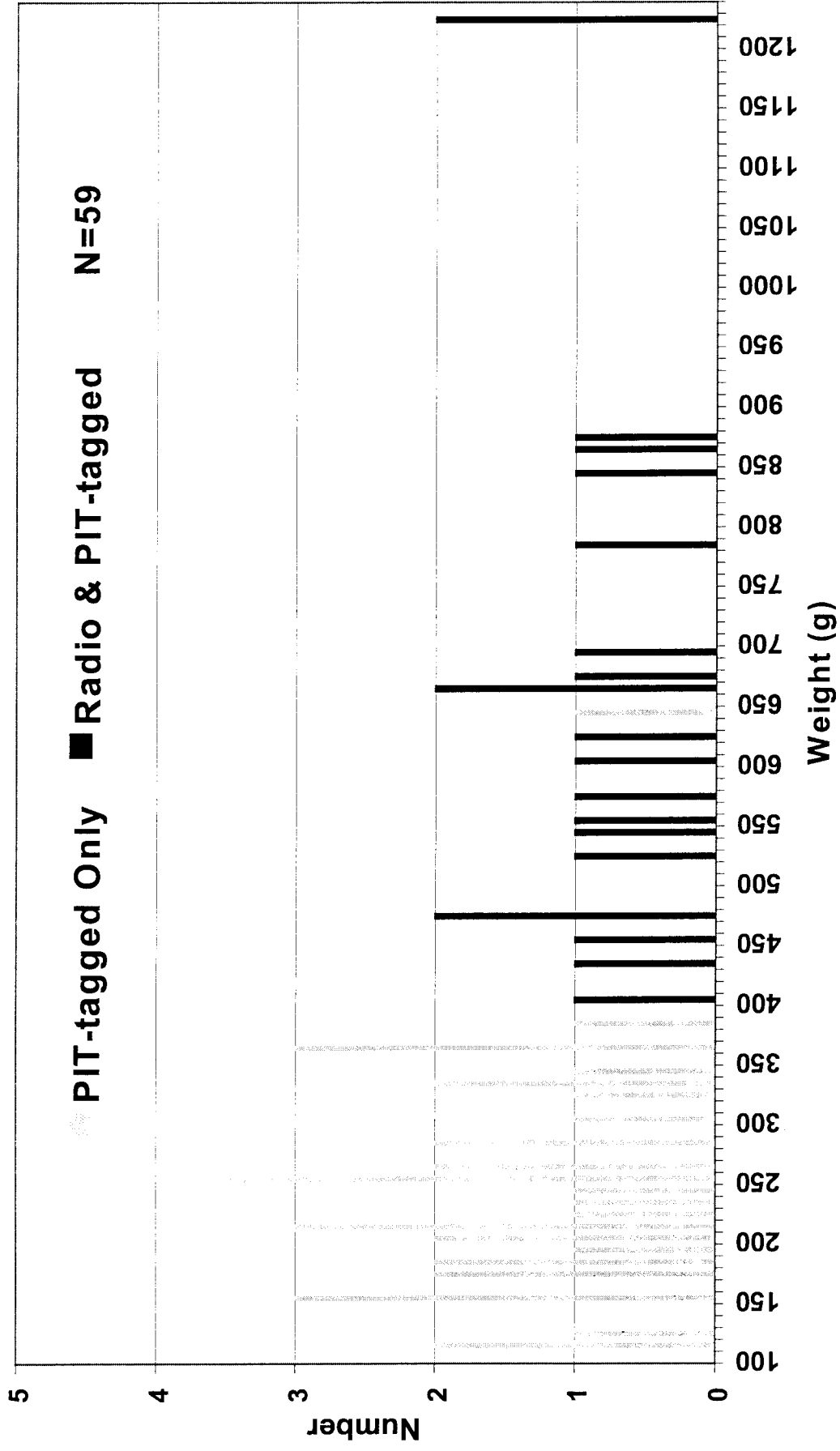


Figure 3. Weight distribution of bull trout captured by hook-and-line sampling in Dworshak Reservoir, April-May 2000.

Table 1. Radio-tagged bull trout distribution in the North Fork Clearwater River, 2000.

Bull Trout Radio Number (Frequency-Code)	Subgroup	Date past CWC upstream	Date located at maximum migration point <sup>2</sup>	Days of upstream migration from CWC	Date past CWC on downstream migration	Total days in riverine habitat	Maximum upstream migration distance from CWC (km)	Migration distance from tagging location (km) <sup>1</sup>	Migration rate from CWC site to KFWC site (km/d)	Total migration rate (km/d) <sup>2</sup>
930-16	Black Canyon	3-Jun-00	20-Jul-00	47.0	21-Sep-00	110	85.0	97.9	7.8	1.8
930-14	Black Canyon	18-Jun-00	20-Jul-00	32.0		*	99.8	110.6	3.3	3.1
930-19	Black Canyon	20-Jun-00	20-Jul-00	43.0		*	100.4	113.0	3.3	2.3
910-16	Black Canyon	4-Jun-00	8-Aug-00	65.0	14-Sep-00	103	100.4	117.0	2.0	1.5
930-22	Black Canyon	8-Jun-00	8-Aug-00	61.0		**	116.4	133.0		1.9
910-13	Black Canyon	1-Jun-00	8-Aug-00	68.0		**	113.1	129.7		1.7
930-18	Black Canyon	3-Jun-00	8-Aug-00	66.0		***	100.4	117.0		1.5
<b>Averages</b>		<b>8-Jun-00</b>	<b>28-Jul-00</b>	<b>54.6</b>		<b>106.5</b>	<b>102.2</b>	<b>116.9</b>	<b>2.3</b>	<b>2.0</b>
930-12	Kelly Creek	17-Jun-00	20-Jul-00	33.0		**	93.0	112.0	4.4	2.8
910-17	Kelly Creek	18-Jun-00	20-Jul-00	32.0		*	89.7	100.5	2.9	2.8
910-20	Kelly Creek	3-Jun-00	20-Jul-00	47.0		123	85.8	102.4	1.7	1.8
930-26	Kelly Creek	26-Jun-00		11.0		***		82.5	6.4	6.4
<b>Averages</b>		<b>16-Jun-00</b>	<b>20-Jul-00</b>	<b>17.6</b>			<b>89.5</b>	<b>99.4</b>	<b>3.9</b>	<b>3.5</b>
930-17	Weitas Creek	16-Jun-00	20-Jul-00	34.0		**	68.0	78.8		2.0
910-19	Lower NFCR	2-Jul-00	20-Jul-00	18.0		124	1.6	14.5		0.1
930-25	Lower NFCR	29-Jun-00	5-Jul-00	6.0		***	8.9	19.7		1.5
930-29	Lower NFCR	6-Jun-00	13-Jun-00	5.0	3-Oct-00	119	8.9	19.7		1.8
<b>Averages</b>		<b>22-Jun-00</b>	<b>2-Jul-00</b>	<b>9.7</b>		<b>121.5</b>	<b>6.5</b>	<b>18.0</b>		<b>1.1</b>
910-15	Dworshak		23-Jun-00			0		-76.1		
930-20	Dworshak		5-Jul-00			0		-8.0		
910-11	Dworshak		5-Jun-00			0		-7.2		
910-12	Dworshak		2-Jun-00			0		2.4		
910-14	Dworshak					0		-1.8		
930-11	Dworshak		5-Jul-00			0		7.6		
<b>Averages</b>			<b>20-Jun-00</b>					<b>19.1</b>		

<sup>1</sup> A negative number indicates that the bull trout moved downstream from its tagging location.

<sup>2</sup> Date located at maximum migration is within 9 days of actual date due to flight schedule.

\* Bull trout still located within the riverine habitat.

\*\* Mortality or shed of tag within riverine habitat.

\*\*\*Transmitter malfunction or transmitter removed from study area.

The Black Canyon group was comprised of seven tagged individuals situated between Elizabeth Creek, rkm 178.4, and Niagara Gulch, rkm 213.0 (Figures 4 and 5). Two tagged individuals (930-16 and 930-14) remained within the Black Canyon reach in the mainstem, while the other five migrated into tributaries (Figures 4 and 5). Bull trout 930-19 and 910-16 migrated into Lake Creek, rkm 197 (Figure 4). Bull trout 930-22 and 910-13 migrated into Niagara Gulch and Placer Creek, rkm 213.0 and 209.7, respectively. These two bull trout traveled the farthest upstream at distances of 133 km and 129.7 km, respectively (Table 1), from tagging location. Bull trout tag 930-22 was found with a fish mandible bone on a gravel bar below a small plunge pool in Niagara Gulch. We suspect that an otter took this fish because the plastic-coated transmitter wire had noticeable teeth indentations. It could not be determined if this bull trout spawned, but 20 m above the tag a bull trout redd was identified. In Placer Creek, another bull trout tag (910-13) was located lying next to a redd. It is presumed that this tag was expelled during spawning because there were no indications of mortality and the transmitter was in good condition. The remaining bull trout of this subgroup, 930-18, was last located at Cedars Campground, rkm 197.0 (Figure 4). This individual was moving upstream steadily before the transmitter signal weakened and became undetectable after August 8.

The Kelly Creek subgroup was comprised of three tagged individuals (930-12, 910-17, and 910-20) (Figure 6). Bull trout 910-20 remained in the mainstem Kelly Creek at approximately rkm 182.4 (below Scurvy Creek) for approximately 50 days. It was first located at this location on July 7 and last located at the same site on September 7. The remaining two fish migrated into Moose Creek, rkm 184.7. Individual 910-17 moved 1.6 km up Moose Creek where it remained for the summer until at least September 7 before migrating back into the NFCR. The remaining bull trout, 930-12, migrated into Swamp Creek and was located approximately 4.9 km upstream from the mouth of Moose Creek (Figure 6). This radio transmitter was still located in Swamp Creek at the end of September, but it is believed the fish died or shed the tag after spawning. Bull trout 930-26 was located only once within the drainage at KFR station (rkm 166.5) on July 7 (Figure 5). We believe that the radio transmitter was faulty or the fish was illegally harvested, as we were unable to detect the tag after this date.

Bull trout 930-17 was the only radio-tagged fish to migrate into the Weitas Creek drainage (Figure 7). This fish traveled approximately 20.8 km up Weitas Creek, where it remained throughout the summer. The transmitter was still located within Weitas Creek in February 2001, and it was probably shed during spawning because the fish was located and believed to be alive during August. Due to remoteness of the area, redd surveys were not conducted and the tag was not retrieved.

Bull trout 910-19 was found in the NFCR at approximately rkm 98.2 for the duration of the summer and fall (Figure 8). This bull trout had not returned to the reservoir as of February 2001. Radio-tagged bull trout 930-29 migrated into the NFCR during the summer and was detected on June 13 near Skull Creek, rkm 105.5 (Figure 8). However, it was not detected again until October 3 at the CWC fixed site. We assumed the transmitter was sending out a weak signal and could only be detected from a close proximity. On July 5, bull trout 930-25 was located near Skull Creek, rkm 105.5 (Figure 8) and bull trout 930-11 was located below the Aquarius Bridge, rkm 93.4 (Figure 8). Since then, these two bull trout have not been located. It is unknown what happened to these individuals, but it is hypothesized that either their transmitters malfunctioned or they were illegally harvested.

The remaining five individuals were not recorded on the CWC site. It is presumed these individuals remained within Dworshak Reservoir throughout the study period. Bull trout 910-15 was last located on June 23 above Indian Creek (rkm 9.7) 6.5 km from Dworshak Dam (Figure 9). The loss of this fish could have been due to the fish retreating below the 10-meter detectable depth for the transmitters during stratification of the reservoir over the summer.

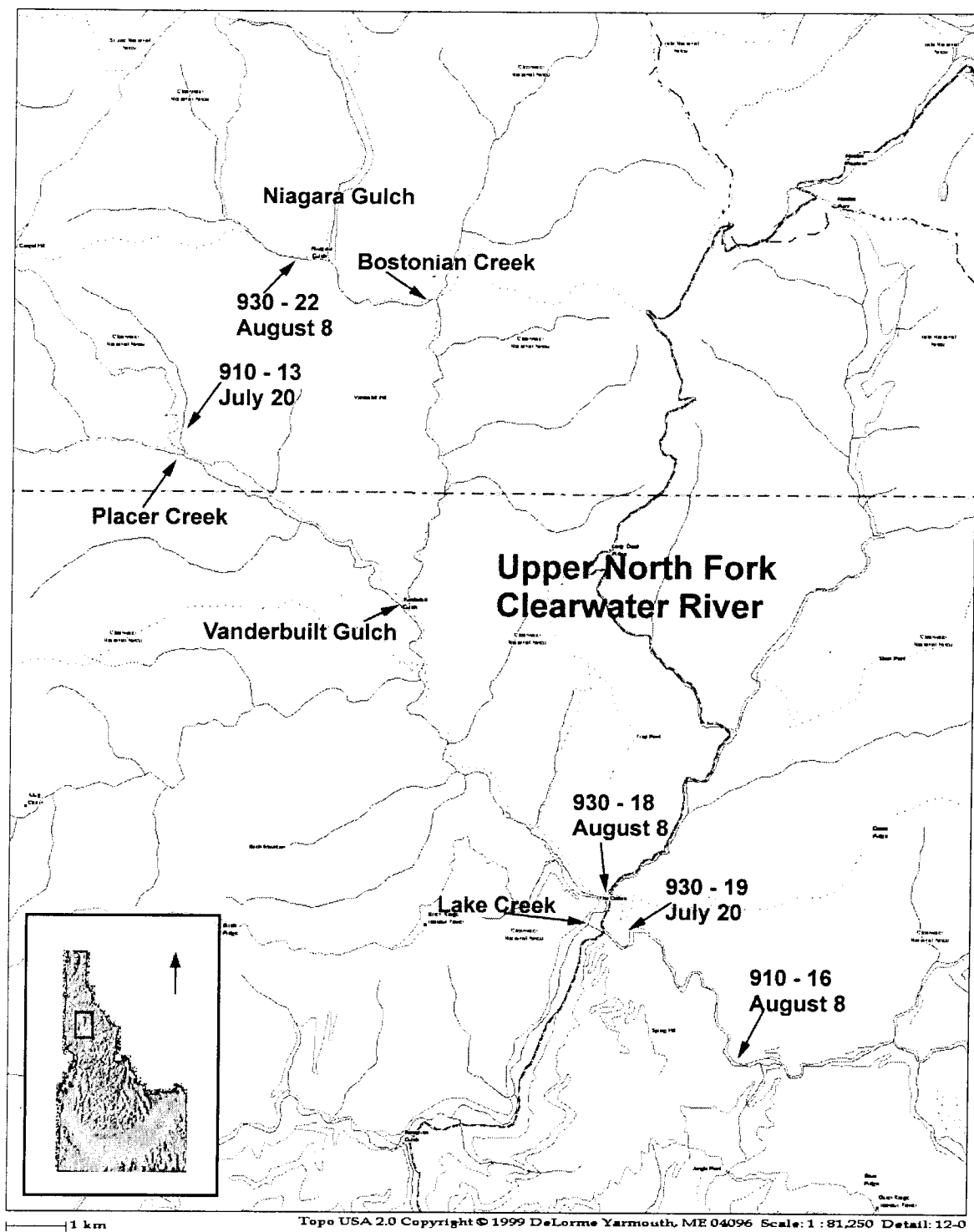


Figure 4. Radio-tagged bull trout distribution in the upper North Fork Clearwater River drainage, July-August 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was first located at the site.

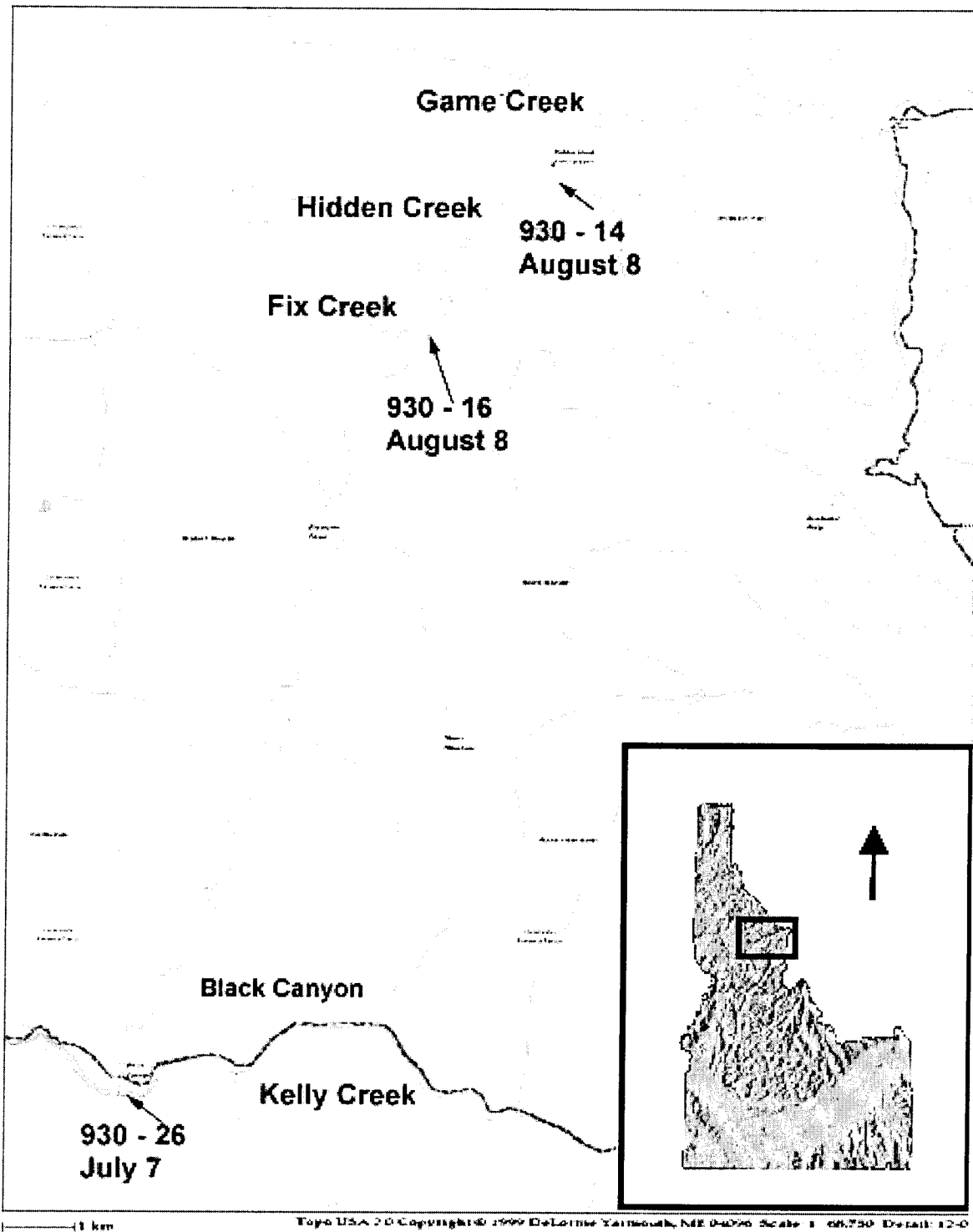


Figure 5. Radio-tagged bull trout distribution in the Black Canyon Reach, NFCR, July-August 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was first located at the site.

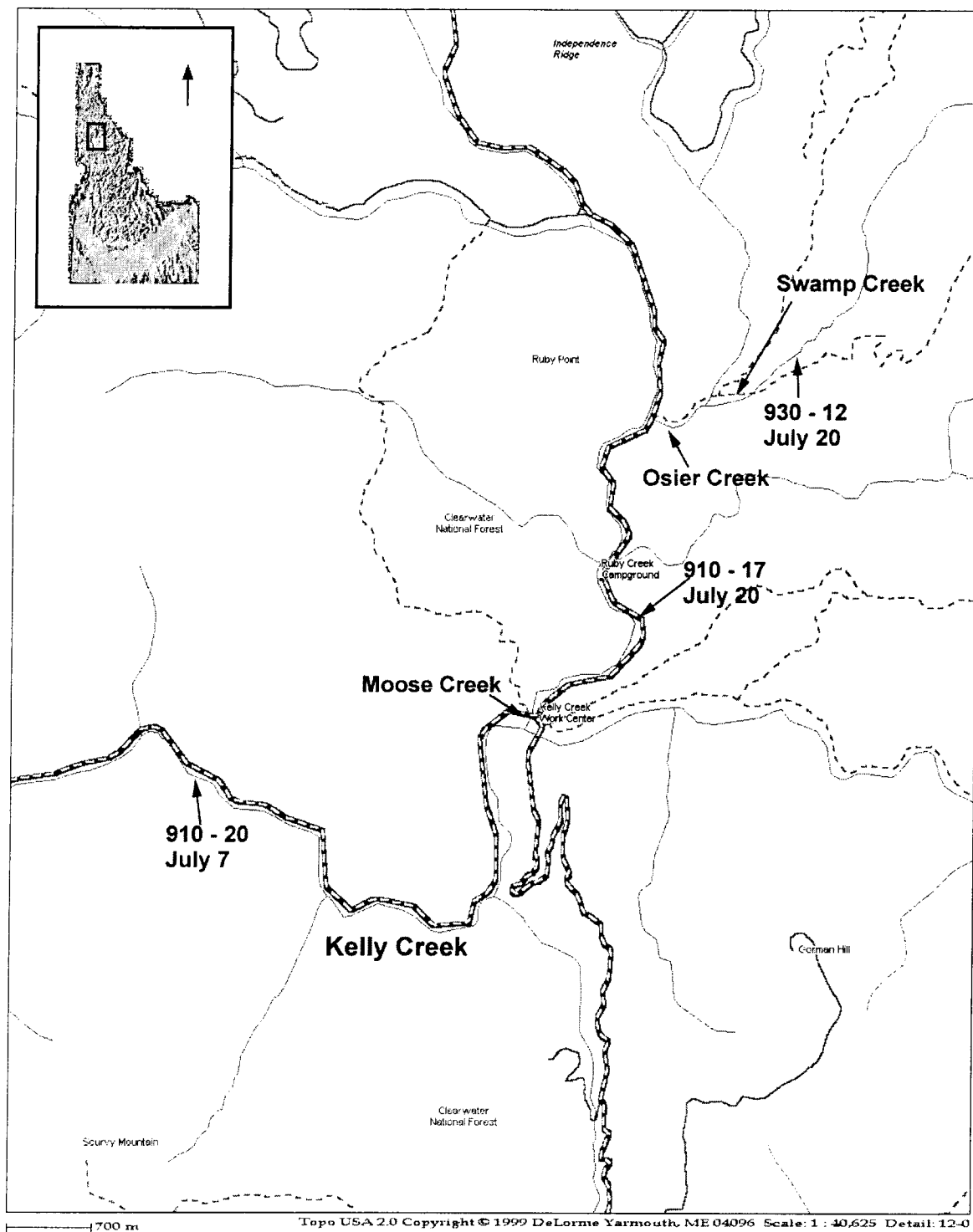


Figure 6. Radio-tagged bull trout distribution in Kelly Creek drainage, July-September 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was first located at the site.

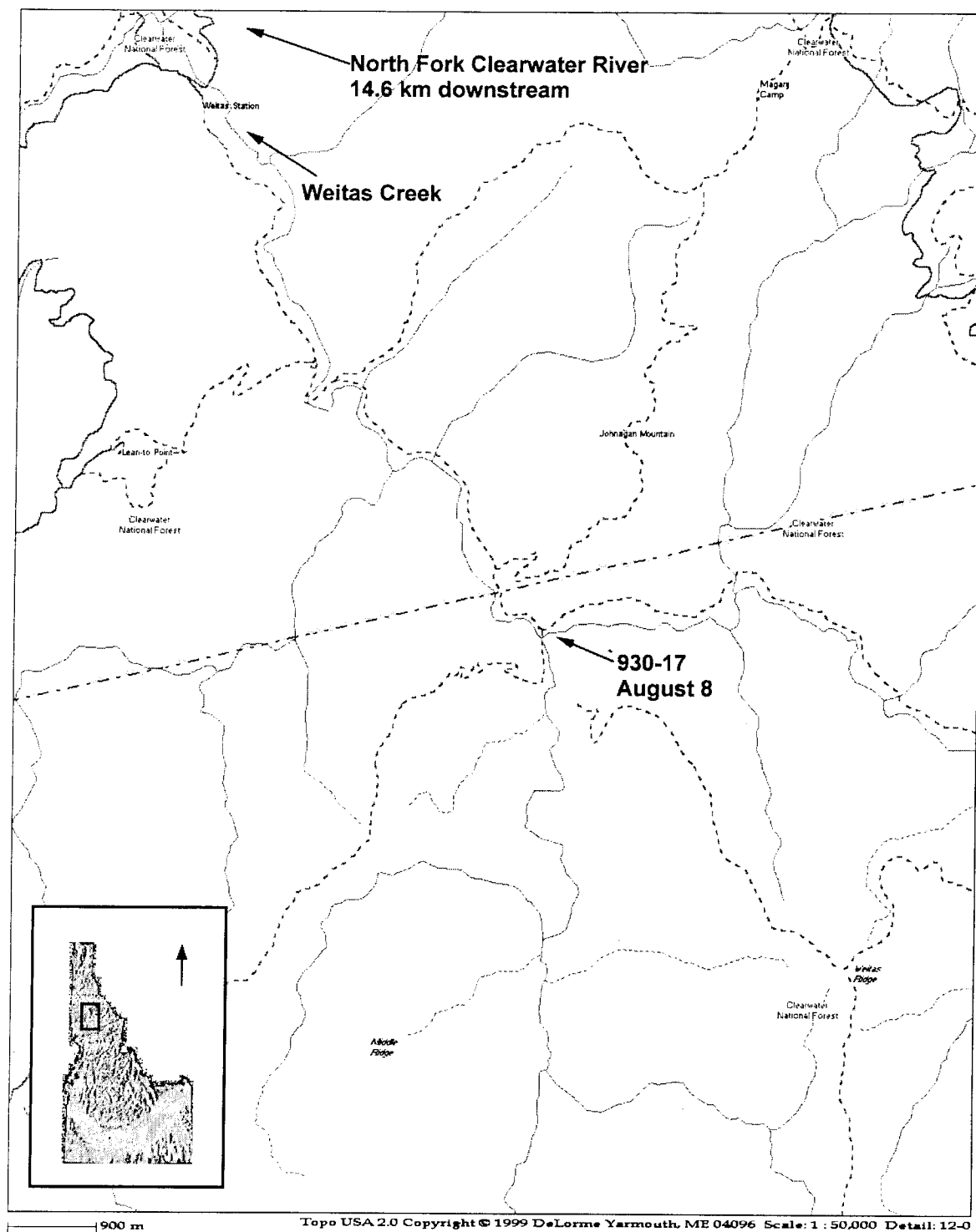


Figure 7. Radio-tagged bull trout distribution in Weitas Creek, July-August 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was first located at the site.

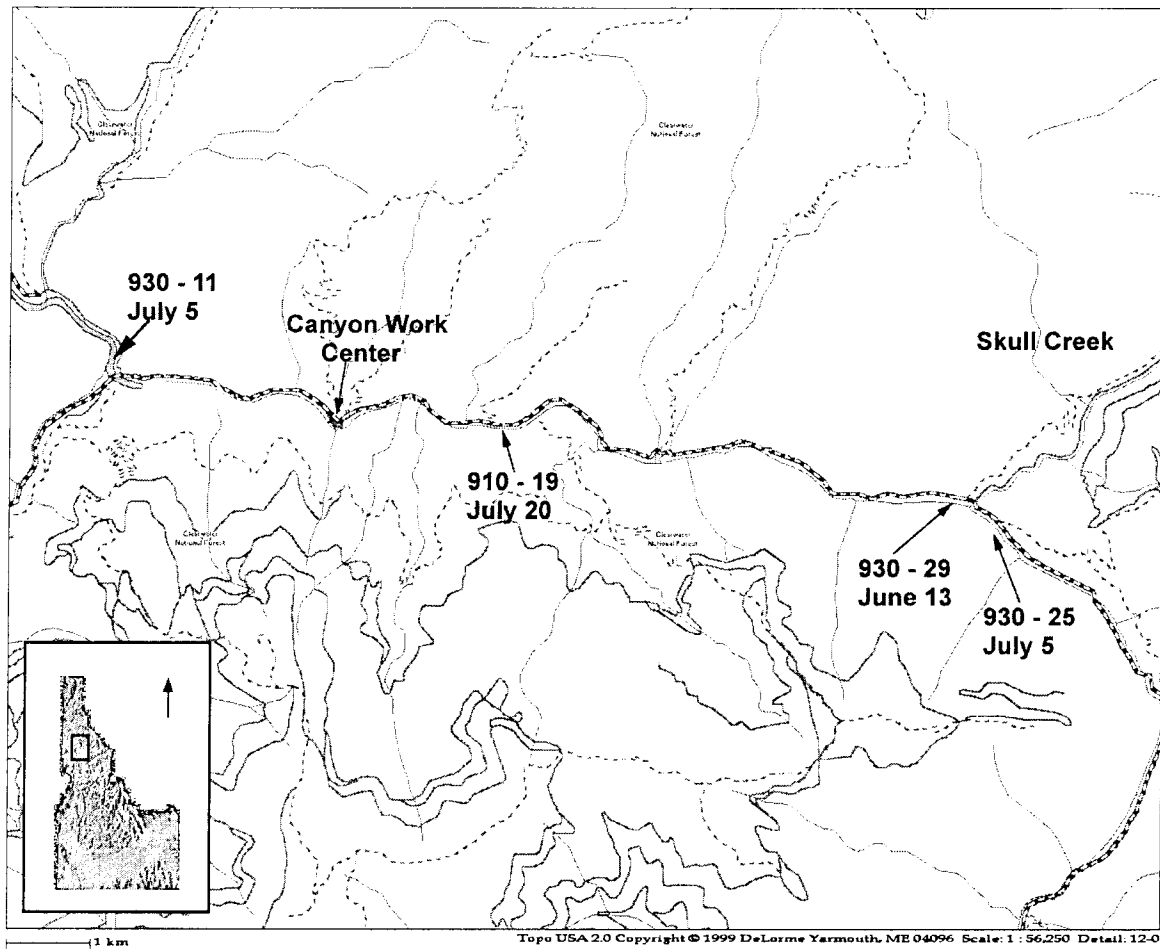


Figure 8. Radio-tagged bull trout distribution in the lower NCFR, July - August 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was first located at the site.

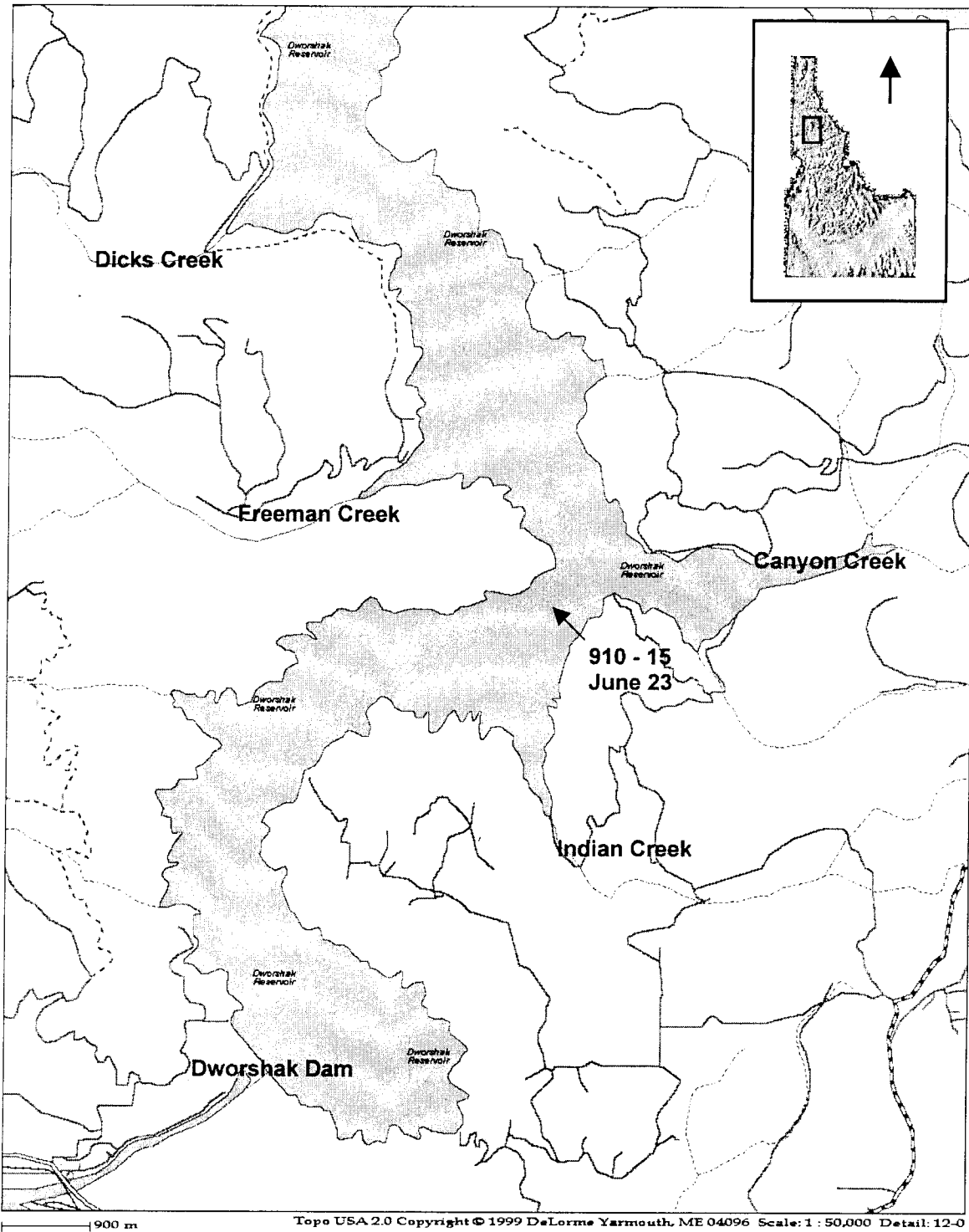


Figure 9. Radio-tagged bull trout distribution in lower Dworshak Reservoir, June 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was last located at the site.

Two bull trout (930-20 and 910-11) were last found between Telephone Creek and Joe's Creek (rkm 77.8 and 85.8), but have not been located since July 5 and July 20, respectively (Figure 10). Bull trout 910-12 was also located in this region on June 5, but has not been detected since (Figure 10). As of February 2001, these bull trout were not located during flights over Dworshak Reservoir. It cannot be determined what happened to these individuals after these dates. It is hypothesized that they either migrated into another tributary of Dworshak Reservoir, died in the reservoir during the summer, or that their transmitters malfunctioned.

Only bull trout 910-14 was radio-tracked throughout the summer and winter in the reservoir (Figure 10). This bull trout remained at the upper end of Dworshak Reservoir throughout the study period in an area where the water depth is less than 10 m deep and more riverine than reservoir in nature. The bull trout was in the upper end of Dworshak Reservoir in February 2001.

### **Spawning Sites**

Bull trout redd surveys were conducted September 9-12 on the following tributaries: Lake, Niagara Gulch, Osier, Placer, and Swamp creeks. These tributaries were selected because radio-tagged individuals migrated through or to these areas in the summer of 2000. A second count was to be conducted on these areas, but because of a high water event in September the identification of new bull trout redds was not possible. A total of 30 bull trout redds were observed in this group of tributaries (Table 2). The number of redds observed was highest in Lake Creek (Table 2). The numbers of bull trout redds identified in Swamp and Osier creeks could be an underestimate due to the large number of kokanee spawning in these creeks at the same time. One bull trout redd was identified in Weitas Creek (Table 2) near the location of the radio-tagged bull trout. A complete survey was not conducted within the drainage in 2000. Due to the size of the stream no redd surveys were attempted on the NCFR.

### **Life History Information**

Scale samples collected from 59 bull trout captured in Dworshak Reservoir will be pressed, aged, and reported in the next progress report. Adipose fin samples were collected for future genetic analysis. The length-weight relationship for these bull trout is presented in Figure 11, and can be described by the equation  $\log(\text{weight}) = \log(\text{fork length}) + \text{constant}$ . The equation is:  $y = 3.0088x - 5.1372$ .

## **FISH LAKE**

### **Objectives**

1. Determine population size and obtain basic life history information.
2. Determine incidental-hooking mortality of bull trout.
3. Determine the interaction and connectivity between Fish Lake and the North Fork Clearwater River bull trout populations.
4. Identify spawning area(s).

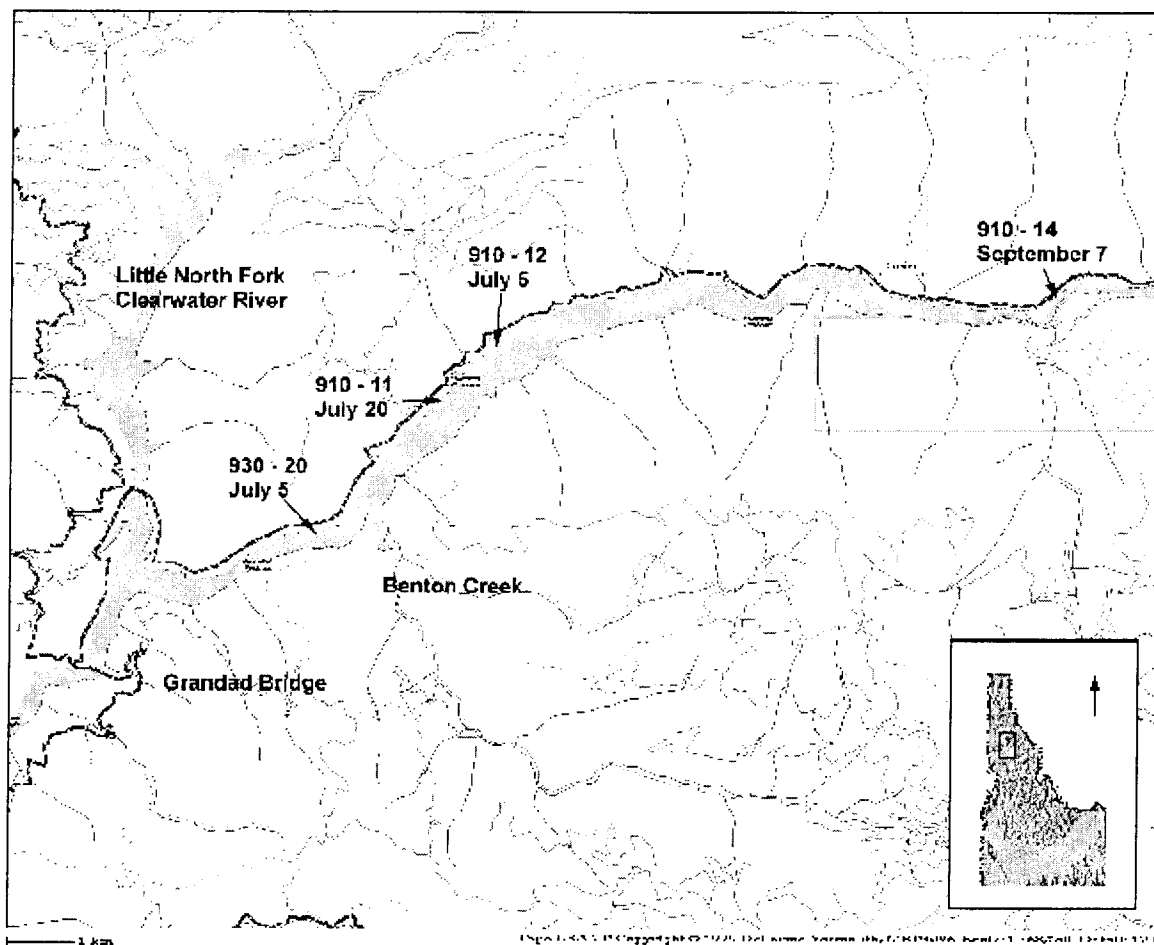


Figure 10. Radio-tagged bull trout distribution in upper Dworshak Reservoir, June-August 2000. Radio frequency and code identifies individual fish. Date indicates the day the fish was last located at the site.

Table 2. Redd surveys in tributaries of the NFCR, September 2000.

Stream Name	Date	Redd Number	Size (cm <sup>3</sup> )
Lake Creek	11-Sep-00	LCK-1	3150
	11-Sep-00	LCK-2	36000
	11-Sep-00	LCK-3	3500
	11-Sep-00	LCK-4	2800
	11-Sep-00	LCK-5	4400
	11-Sep-00	LCK-6	9800
	11-Sep-00	LCK-7	11900
	11-Sep-00	LCK-8	24500
	11-Sep-00	LCK-9	13600
	11-Sep-00	LCK-10	30000
	11-Sep-00	LCK-11	12600
	11-Sep-00	LCK-12	6600
	11-Sep-00	LCK-13	7000
	11-Sep-00	LCK-14	31500
	11-Sep-00	LCK-15	5400
	11-Sep-00	LCK-16	1125
	11-Sep-00	LCK-17	1625
	11-Sep-00	LCK-18	4550
	11-Sep-00	LCK-19	9600
<b>Average size</b>			<b>11561</b>
Niagara Gulch	12-Sep-00	NG-1	1200
	12-Sep-00	NG-2	1800
<b>Average size</b>			<b>1500</b>
Osier Creek	9-Sep-00	OCK-1	3600
	9-Sep-00	OCK-2	1225
	9-Sep-00	OCK-3	750
<b>Average size</b>			<b>1858</b>
Placer Creek	12-Sep-00	PCK-1	6500
	12-Sep-00	PCK-2	4900
	12-Sep-00	PCK-3	3000
<b>Average size</b>			<b>4800</b>
Swamp Creek	9-Sep-00	SWC-1	3750
	9-Sep-00	SWC-2	2500
<b>Average size</b>			<b>3125</b>
Weitas Creek	19-Sep-00	WCK-1	34500

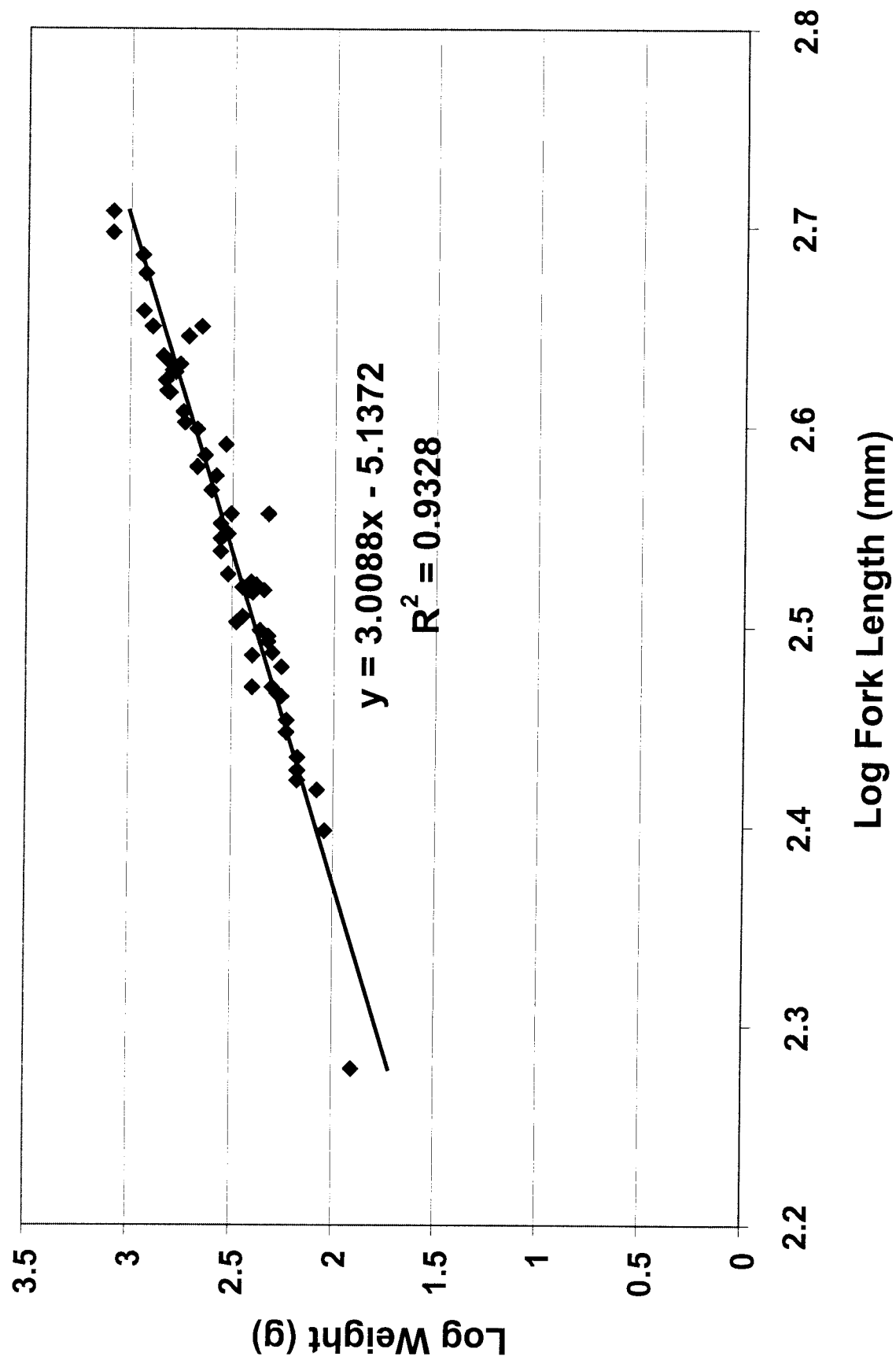


Figure 11. Length-weight relationship for bull trout captured in Dworshak Reservoir, April-May 2000.

## **Study Area**

Fish Lake is an oligotrophic mountain lake with a surface area of approximately 46.5 ha at an elevation of 1,812 m (Murphy and Cochnauer 1998). It is located in the upper NFCR drainage on the crest of the Bitterroot Divide forming the Idaho-Montana border. It is situated in a glacial trough with glacial ridges on the north and east, a strongly scoured cirque basin and headwall to the south, and the continuation of the glacial trough bottom to the west. It has a maximum depth of 41.5 m with 90% of the surface area greater than 3 m deep (Murphy and Cochnauer 1998). There are five small inlets (0.35-1.0 m wide and 7-30 cm deep). Four inlets enter on the eastern end of the lake. The largest is a 1.0 m wide spring origin inlet. This larger spring-fed inlet has spawning size gravels, but no bull trout spawning activity has been observed. The last inlet on the north side of the lake is also small and originates in a large seep area. There is one outlet, Lake Creek, exiting on the west side of the lake flowing 19 km to the NFCR. The surrounding area is dominated by Engelmann spruce *Picea engelmannii*, Douglas fir *Pseudotsuga menziesii*, and associated sub-alpine understory.

Fish Lake supports bull trout and westslope cutthroat trout populations. Westslope cutthroat trout are known to utilize the outlet for spawning. Eggs were taken in 1957, 1958, 1970, 1971, and 1972 to start a hatchery westslope cutthroat trout broodstock program for lake stocking. Westslope cutthroat trout have been stocked four times in Fish Lake (1970, 1971, 1972, and 1977). Except for the 1977 stocking, all fish stocked are believed to have originated from eggs taken at Fish Lake. The 1977 stocking is from hatchery-raised brood stock originating from Fish Lake in 1972. Since 1970, Fish Lake has been managed under a restricted sportfishing season opening August 1. Annual season closing dates have varied from September 15 to November 30. The late opening date has allowed for westslope cutthroat trout to spawn prior to the sport-fishing season. Fish Lake supported a bull trout sport harvest prior to closure in 1995.

There is limited information on the fish populations within Fish Lake. Limited annual angler creel information is available since 1973 describing catch-per-unit-effort (CPUE) data, but this data is restricted to the opening week or weekend only. The Idaho Department of Fish and Game (Department) has used the CPUE data for population trend analysis. There is also limited population sampling data since 1974 when experimental gill nets were set overnight, but this has not occurred on a regular basis. There has never been any type of concentrated study on the fish populations or their life history characteristics.

## **Methods**

Beginning the last week of June, bull trout were collected using an experimental monofilament gill net. Gill net sets were conducted from one hour before sunset until two repetitive gill net sets did not capture any bull trout. All gill nets were set for a maximum of twenty minutes to minimize mortality. All bull trout captured were held overnight in a circular (0.91 m diameter by 1.22 m deep) mesh holding pen to eliminate the probability of recapture the same evening. The following morning all bull trout were individually anesthetized in a 60-80 mg/l solution of MS222. They were weighed to the nearest 5 g and measured to the nearest millimeter for fork and total length. All bull trout were PIT-tagged. If the individual weighed 140 g or less it was tagged in the dorsal sinus; otherwise it was tagged in the left opercular muscle. Adipose fins were removed and stored in a 95% alcohol solution for later genetic analysis. A scale sample was collected for age determination.

Hook-and-line sampling was conducted during the day to collect westslope cutthroat and bull trout. All bull trout were handled as previously stated except they were not held overnight. They were immediately measured, weighed, tagged, and released. Cutthroat trout were measured to the nearest millimeter for total length, and the left pelvic fin was removed for future identification.

We conducted angler creel surveys beginning on the opening of the sportfishing season (August 1). The survey determined the number of cutthroat and bull trout handled by anglers, the gear type used, and possible injury to bull trout. This was conducted every weekend in August, and randomly at least one day per week. Creel data was analyzed using the Department Creel Survey System (McArthur 1990). All bull trout found dead while conducting angler interviews were collected and necropsied. Total fork lengths and weights were measured, and otoliths and scale samples were collected. If the bull trout was a female with mature eggs, the eggs were counted to determine fecundity. Breakage of eggs during the initial count eliminated the possibility of recounting to determine accuracy.

## **Results**

### **Tagging**

A total of 46 bull trout were captured. Six were captured on June 21, 2000 by hook-and-line, while the rest were captured by gill net June 21-28 and July 9 (Appendix C). Sampling was discontinued after July 9 because surface temperatures were greater than 15°C, which is above our safe handling temperature protocol for bull trout. Bull trout had a fork length distribution of 180-330 mm and a weight distribution of 45-280 g (Figures 12 and 13).

Gillnetting and hook-and-line sampling during June and July 2000 captured a total of 134 cutthroat trout with a length frequency of 175–430 mm (Figure 14).

### **Angler Creel**

A total of 135 cutthroat trout with a corresponding length frequency of 150-335-mm were sampled in angler creels (Figure 14). There was no significant difference in the mean size of cutthroat trout caught during gill net and hook-and-line sampling and those in the angler creel (279 mm and 280 mm [P-value 0.756], respectively) (Figure 14). The estimated number of angler hours for the month of August was 425 hrs (+/- 192 hrs 95% CI). The first week and weekend of angling constituted 283 hours (+/- 170 hrs 95% CI) representing 67% of the total angling effort. The estimated number of cutthroat trout caught was 867 with an estimated 716 (+/- 630 95% CI) being harvested and 151 (+/-81 95% CI) being released.

Angler surveys identified the incidental hooking of 114 bull trout, with 97% being caught on bait and the remainder on lures. The estimated number of bull trout caught and released during August was 227 (+/- 140 95% CI). Estimates of hooking mortality ranged from 5% to 60% (Wydoski 1977+, Mongillo 1984) with 60% a worst-case scenario (Thurow 1990) within stream systems. The range of hooking mortality is estimated using bait anglers only, because mortality of trout caught and released with artificial flies or lures is not significant and is approximated at zero (Thurow 1990). We estimated mortality to be the percent (97%) of bull trout caught by bait anglers times the estimates of mortality. We estimated bull trout mortality at 60% to be 132 (+/- 81 95% CI), with the best case of 5% mortality to be 11 (+/- 7 95% CI). We can assume that the best-case scenario is not feasible because we documented 12 bull trout mortalities during August. This could have been caused by added stress due to high surface

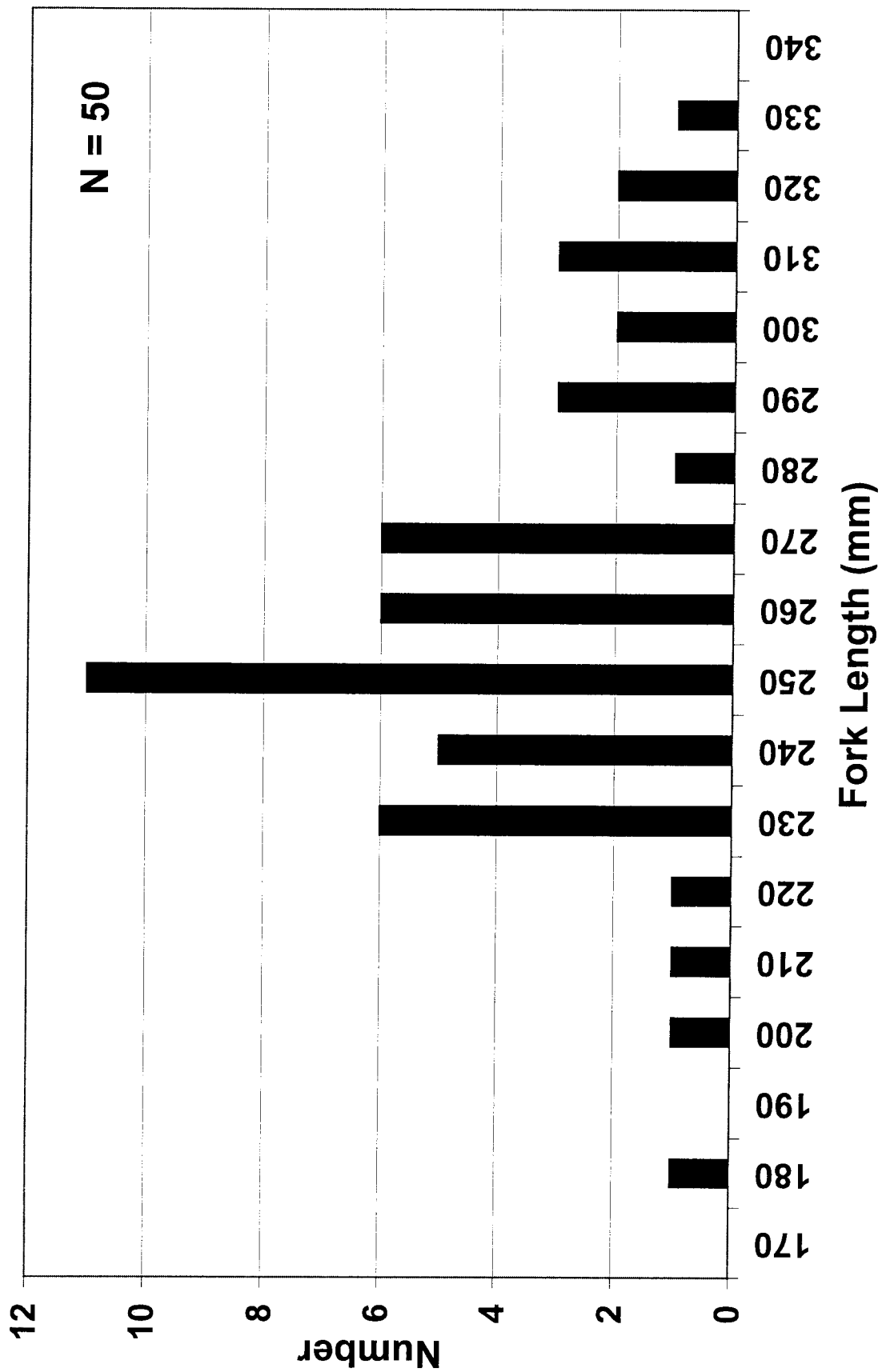


Figure 12. Length distribution of bull trout captured by gillnets and hook-and-line sampling in Fish Lake, June-July 2000.

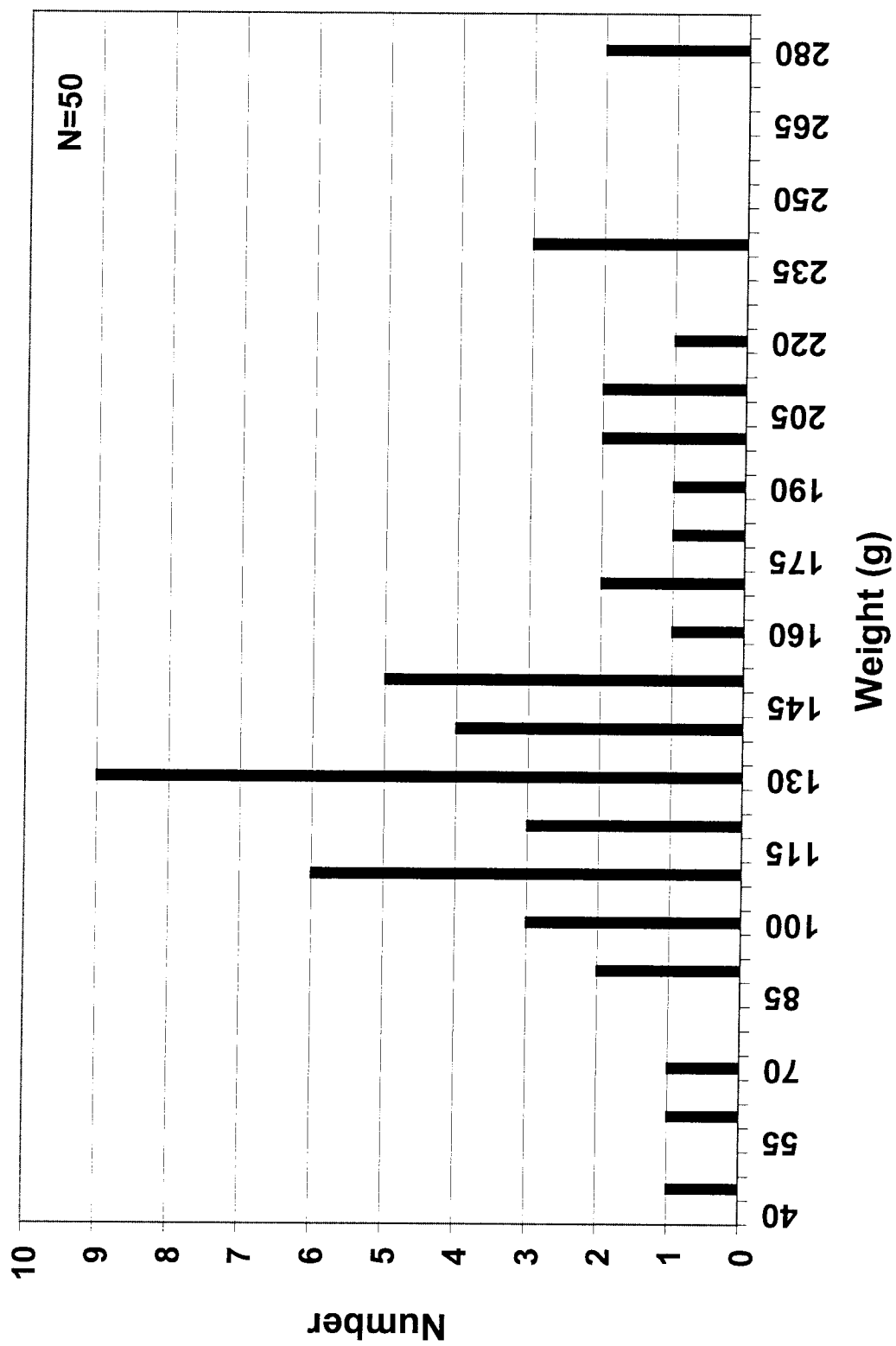


Figure 13. Weight distribution of bull trout captured by gill nets and hook-and-line sampling in Fish Lake, June-July 2000.

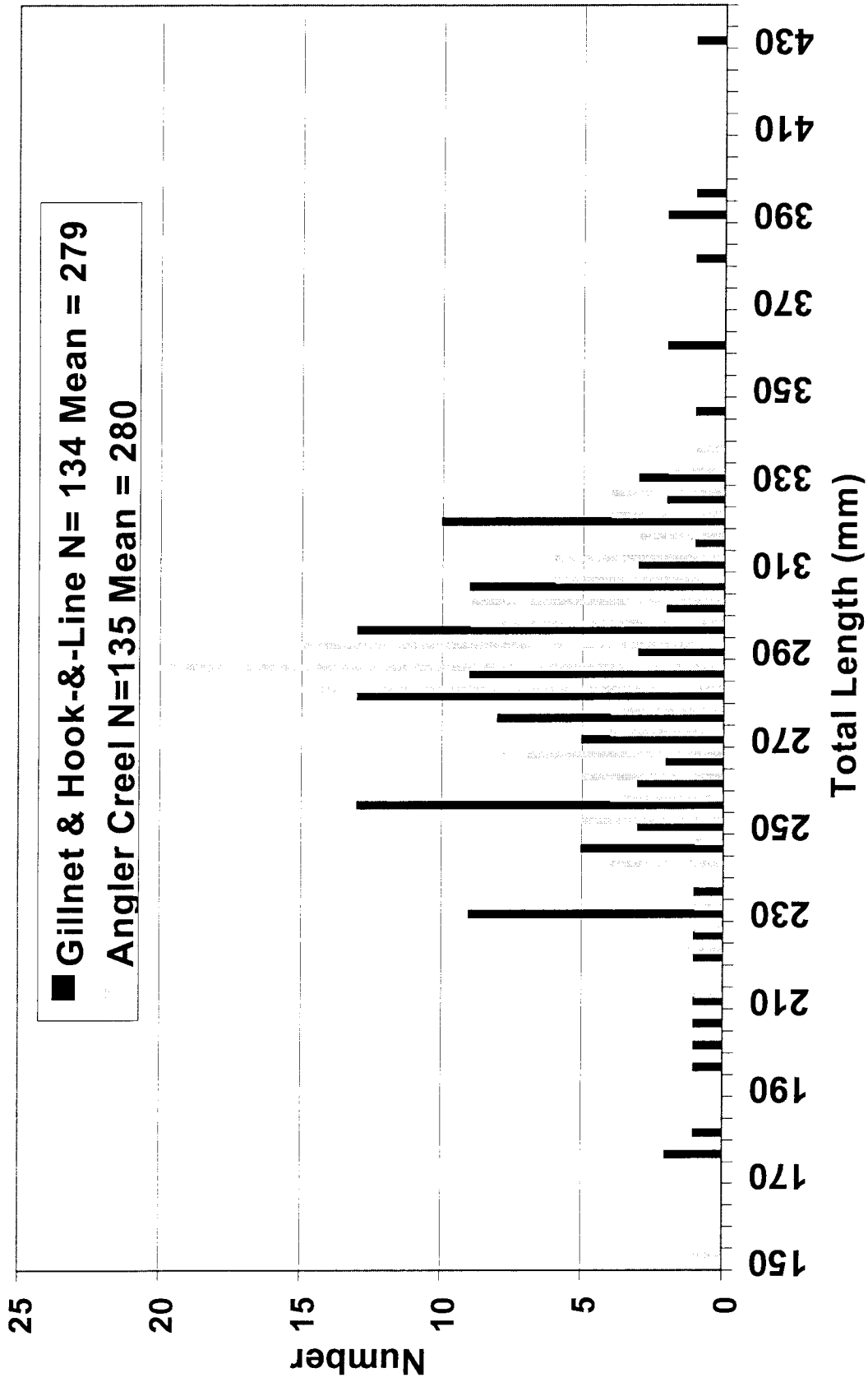


Figure 14. Length distribution of cutthroat trout in Fish Lake, collected from sampling data in June-July and angler creel data in August 2000.

temperatures ranging from 20°C to 25°C throughout August. Therefore, these should only be used as estimates on mortality as actual numbers may be higher than those predicted.

### Life History Characteristics

During creel surveys ten dead bull trout were collected and necropsied. Of these bull trout six were female, two were male and two could not be sexed (Table 3). Four of the females were mature, but an egg count was not completed on one. Fecundity ranged from 282–461 eggs/female with a mean of 388 eggs/female (Table 3).

Table 3. Bull trout collected due to angler hooking mortality in Fish Lake, August 2000.

Date	BT ID Number	Fork Length	Total Length	Sex	Genetics Number	Egg Count
8/1/00	BT 01	259	273	FEMALE	FL 47	422
8/1/00	BT 02	264	280	FEMALE	FL 48	461
8/1/00	BT 03	263	271	FEMALE	FL 49	IMMATURE
8/1/00	BT 04	271	281	FEMALE	FL 50	282
8/1/00	BT 05	300	312	MALE	FL 51	
8/2/00	BT 06	241	255	MALE	FL 52	
8/2/00	BT 07	280	294	UNKNOWN		
8/12/00	BT 08	262	278	FEMALE	FL 53	NO DATA
8/13/00	BT 09	275	292	UNKNOWN	FL 54	
8/13/00	BT 10	291	317	FEMALE	FL 55	IMMATURE

For aging purposes scale samples were collected from all 50 bull trout captured in Fish Lake. Age determination will be made at a later date. Adipose fin samples were collected for future genetics analysis. The length-weight relationship for these bull trout is shown in Figure 15 and described by the equation  $\log(\text{weight}) = \log(\text{fork length}) + \text{constant}$ . The equation is  $y = 2.8752x - 4.7054$  (Figure 15).

### DISCUSSION

The first year of this study documented trends in migration patterns and identified critical habitat areas utilized seasonally by bull trout. Continuation of the study in 2001 will include expansion into the Little North Fork Clearwater River drainage. This additional information will help document migration timing and habitat use within the NFCR drainage to ensure identification of critical areas for these bull trout populations. The project will identify spawning aggregates and help to establish a bull trout population size and status within the drainage.

Estimates of incidental hooking mortality on caught and released bull trout in Fish Lake appear to be high. Currently, an assessment of bull trout population level effects cannot be completed. Determination of population size will allow estimates of exploitation to be determined. It is unknown if our estimate of catch-and-release mortality exceeds harvest of bull trout prior to no consumptive regulation changes in 1995.

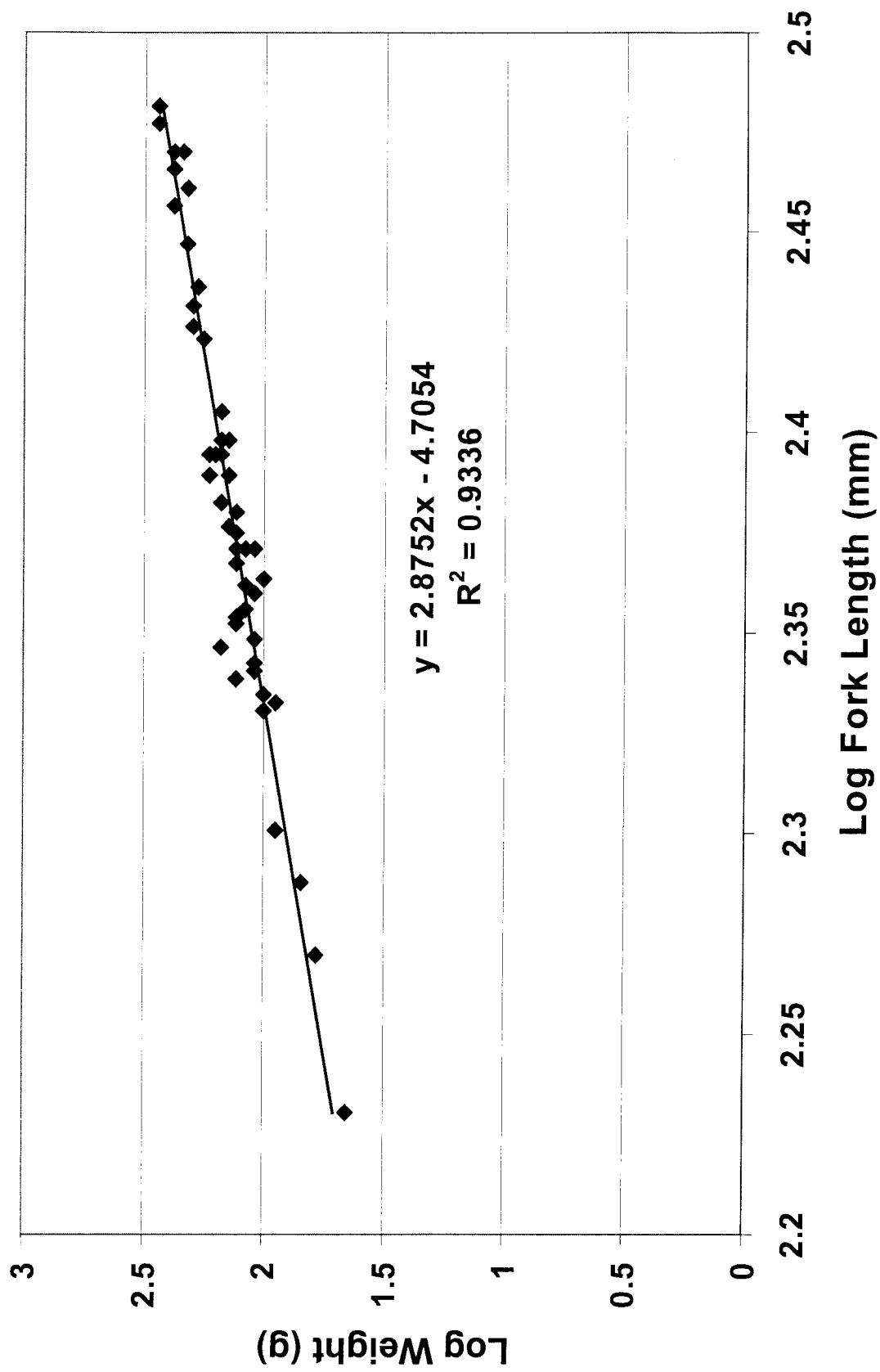


Figure 15. Length-weight relationship for bull trout captured in Fish Lake, 2000.

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## **APPENDICES**

Appendix A. Bull trout captured in Dworshak Reservoir 2000.

Date	Temp	PIT Tag Number	Radio Tag (Frequency - Code)	Total Length (mm)	Fork Length (mm)	Weight	Genetic Number
17-Apr-00	7.5	7F7D052279	148.910-13	455	432	860	NF-A
17-Apr-00	7.5	7F7D04416D	148.910-20	428	405	570	NF-A
17-Apr-00	7.5	7F7D052E26	148.930-22	498	483	1220	NF-D
17-Apr-00		7F7D05305A		293	283	190	NF-G
17-Apr-00		7F7D075619		329	310	250	NF-E
17-Apr-00		7F7D07567D		330	312	220	NF-F
17-Apr-00		7F7D0E3153		315	300	230	NF-C
18-Apr-00	6.3	7F7D053073	148.910-11	447	425	450	NF-H
18-Apr-00		7F7D052174		330	310	250	NF-I
18-Apr-00		7F7D052F14		284	270	170	NF-J
18-Apr-00		7F7D074677		311	293	210	NF-K
18-Apr-00		7F7D074756		307	291	200	NF-L
23-Apr-00	8.0	7F7D0F2700	148.910-14	425	408	620	NF4
23-Apr-00	5.0	7F7D074718	148.910-17	397	370	470	NF1
23-Apr-00		7F7D052E00		360	376	210	NF7
23-Apr-00		7F7D052E48		414	436	640	NF6
23-Apr-00		7F7D075659		332	305	240	NF3
23-Apr-00		7F7D075770		345	330	360	NF2
23-Apr-00		7F7D0F2A50		318	340	300	NF5
24-Apr-00	9.0	7F7D053F4A	148.910-16	405		550	NF16
24-Apr-00	6.0	7F7D05402D	148.930-16	432	420	690	NF10
24-Apr-00	6.0	7F7D052E02	148.930-18	510	490	1220	NF15
24-Apr-00	6.0	7F7D0F2D78	148.930-19	400		540	NF11
24-Apr-00		7F7D05207B		295	180	250	NF12
24-Apr-00		7F7D052E49		295	285	200	NF8
24-Apr-00		7F7D074E42		331	312	280	NF13
24-Apr-00		7F7D075500		292	280	180	NF14
24-Apr-00		7F7D0E216B		350	331	360	NF9
27-Apr-00	8.0	7F7D074C25	148.930-17	424	407	600	NF18
27-Apr-00	8.0	7F7D074260		302	283	180	NF19
27-Apr-00	8.0	7F7D074375		330	315	260	NF17
28-Apr-00	8.0	7F7D07542F		333	315	255	NF20
05-May-00	7.0	7F7D052041	148.910-15	385	365	430	NF31
05-May-00	7.0	416E6A5907	148.930-20	442	420	520	NF24
05-May-00		416F272721		305	290		NF23
05-May-00		7F7D052323		352	332	330	NF22
05-May-00		7F7D053031		313	290	210	NF25
05-May-00		7F7D074514		356	335	360	NF26
05-May-00		7F7D075534		336	315	330	NF27
06-May-00	7.5	7F7D052367	148.910-12	370	345	400	NF29
06-May-00	7.5	7F7D043E78	148.930-12	430	400	660	NF30
06-May-00		7F7D052B2F		320	314	280	NF32
06-May-00		7F7D074105		376	357	380	NF28
06-May-00		7F7D074565		306	288	250	NF21
18-May-00		7F7D05260C	148.930-11	485	465	870	NF33
18-May-00		7F7D075244		360	340	320	NF34
18-May-00		*		220			
24-May-00	8.5	7F7D090A3D	148.930-29	420	400	670	NF37
24-May-00	8.5	7F7D042526		250	235	110	NF35
24-May-00	8.5	7F7D051F55		265	248	150	NF36
24-May-00	8.5	7F7D052437		190	180	80	NF38
25-May-00	10.0	7F7D074C5A	148.910-19	380	360	470	NF43
25-May-00	10.0	7F7D052B1E	148.930-14	415	395	660	NF42
25-May-00	10.0	7F7D074E40	148.930-25	447	422	780	NF44
25-May-00	9.0	7F7D04316E	148.930-26	475	458	840	NF46
25-May-00	10.0	7F7D052027		390	360	340	NF41
25-May-00	10.0	7F7D052325		272	255	150	NF40
25-May-00	10.0	7F7D05303E		262	247	120	NF39
25-May-00	10.0	7F7D07512B		280	265	170	NF45
26-May-00	8.5	7F7D052D04		268	254	150	NF48
* Bull trout was not tagged.							

Appendix B. Radio-tagged bull trout within North Fork Clearwater River drainage, 2000.

Date Tagged	PIT Tag Number	Radio Tag Number	Total Length (mm)	Fork Length (mm)	Weight (g)	Genetic Sample	Tagging Location (rkm)	Percent tag weight to body weight
17-Apr-00	7F7D052279	148.910 - 13	455	432	860	NF-A	80.0	0.93
17-Apr-00	7F7D04416D	148.910 - 20	428	405	570	NF-B	80.0	1.40
17-Apr-00	7F7D052E26	148.930 - 22	498	483	1220	NF-D	80.0	0.82
18-Apr-00	7F7D053073	148.910 - 11	447	425	450	NF-H	80.0	1.78
23-Apr-00	7F7D0F2700	148.910 - 14	425	408	620	4	85.8	1.29
23-Apr-00	7F7D07418	148.910 - 17	397	370	470	1	85.8	1.70
24-Apr-00	7F7D053F4A	148.910 - 16	405		550	16	80.0	1.45
24-Apr-00	7F7D05402D	148.930 - 16	432	420	690	10	84.0	1.45
24-Apr-00	7F7D052E02	148.930 - 18	510	490	1220	15	80.0	0.82
24-Apr-00	7F7D0F2D78	148.930 - 19	400		540	11	84.0	1.85
27-Apr-00	7F7D074C25	148.930 - 17	425	407	600	18	85.8	1.67
5-May-00	7F7D05241	148.910 - 15	385	365	430	31	85.8	1.86
5-May-00	416E6A5907	148.930 - 20	442	420	520	24	85.8	1.92
6-May-00	7F7D052367	148.910 - 12	370	345	400	29	77.6	2.00
6-May-00	7F7D043E78	149.930 - 12	430	400	660	30	77.6	1.52
18-May-00	7F7D05260C	148.930 - 11	485	465	870	33	85.8	1.15
24-May-00	7F7D090A3D	148.930 - 29	420	400	670	37	85.8	1.49
25-May-00	7F7D074C5A	148.910 - 19	380	360	470	43	83.7	1.70
25-May-00	7F7D057B1E	148.930 - 14	415	395	660	42	85.8	1.52
25-May-00	7F7D074E40	148.930 - 25	447	422	780	44	85.8	1.28
25-May-00	7F7D04316E	148.930 - 26	475	458	840	46	84.0	1.19

Appendix C. Bull trout tagged in Fish Lake, 2000.

Date	Temp	PIT-Tag Number	Total Length (mm)	Fork Length (mm)	Weight (g)	Genetic Number
6/21/00	8	7F7D051E5C*	280	267	200	FL-7
6/21/00	8	7F7D07426B*	285	270	200	FL-5
6/21/00	8	7F7D051C33*	295	280	210	FL-6
6/21/00	8	7F7D057F5C*	310	295	220	FL-8
6/21/00	8	7F7D052436*	312	295	240	FL-3
6/21/00	8	7F7D05223E*	322	303	280	FL-4
6/21/00	8	7F7D052E04	304	286	240	FL-1
6/21/00	8	7F7D075A2E	320	300	280	FL-2
6/26/00	12.4	7F7D05254A	241	235	120	FL-10
6/26/00	12.4	7F7D052D4E	241	235	130	FL-12
6/26/00	12.4	7F7D051E54	254	241	150	FL-16
6/26/00	12.4	7F7D07530F	298	292	240	FL-9
6/27/00	12.4	7F7D07565C	211	200	90	FL-17
6/27/00	12.4	7F7D052449	226	215	90	FL-23
6/27/00	12.4	7F7D052D6D	226	214	100	FL-19
6/27/00	12.4	7F7D052C74	228	216	100	FL-20
6/27/00	12.4	7F7D052337	236	222	150	FL-15
6/27/00	12.4	7F7D052D4E	241	237	130	
6/27/00	12.4	7F7D052C31	242	230	120	FL-18
6/27/00	12.4	7F7D053B6D	243	218	130	FL-22
6/27/00	12.4	7F7D053918	250	235	130	FL-21
6/27/00	12.4	7F7D07592C	250	238	140	FL-14
6/27/00	12.4	52573C1002	251	240	130	FL-24
6/27/00	12.4	7F7D03271A	261	248	160	FL-11
6/27/00	12.4	7F7D07506C	263	248	170	FL-13
6/28/00	12.4	5239064045	197	186	60	FL-30
6/28/00	12.4	5257D55277	202	194	70	FL-28
6/28/00	12.4	200877968	230	220	110	FL-26
6/28/00	12.4	201F173A70	230	220	110	FL-29
6/28/00	12.4	521D5A2351	230	219	110	FL-27
6/28/00	12.4	5239504B3D	259	245	170	FL-25
6/28/00	12.4	2009327431	261	248	150	FL-31
7/9/00	14.5	52395D4B3D	259	245	140	
7/9/00	14.5	52573E3A14	261	250	140	FL-34
7/9/00	14.5	7F7D07506C	265	250	150	
7/9/00	14.5	20093F5741	172	170	45	FL-32
7/9/00	14.5	2042011A03	233	231	100	FL-37
7/9/00	14.5	2008623442	237	225	130	FL-46
7/9/00	14.5	521D535122	237	223	110	FL-43
7/9/00	14.5	5258183F14	239	235	110	FL-38
7/9/00	14.5	5257244329	241	227	120	FL-36
7/9/00	14.5	5239165263	242	226	130	FL-44
7/9/00	14.5	504730146C	243	229	110	FL-42
7/9/00	14.5	521D55037A	246	233	130	FL-41
7/9/00	14.5	523A7E485D	254	240	130	FL-35
7/9/00	14.5	7F7D05325E	257	245	140	FL-33
7/9/00	14.5	5257375671	265	254	150	FL-39
7/9/00	14.5	521D576942	290	273	190	FL-45
7/9/00	14.5	2009402B6C	305	289	210	FL-40
7/9/00		**	282	265	180	

\* Bull trout captured by hook-and line sampling.

\*\* Bull trout mortality caused by gillnet.

Submitted by:

Tim Cochnauer  
Regional Fisheries Biologist

Ed Schriever  
Regional Fisheries Biologist

Danielle Schiff  
Senior Fisheries Technician

Approved by:

A handwritten signature in black ink, appearing to read "Bill Hutchinson", written over a horizontal line.

Bill Hutchinson  
Assistant Chief of Fisheries